REMARKS

Claim 1 has been amended to recite that the flange expands in outer and inner diameter from the small-diameter portion to the large-diameter portion. Support for amended Claim 1 can be found at, for example, page 12, line 2 and Fig. 1(a) of the present specification. Claim 13 has been added. Support for Claim 13 can be found for example, the subject matter of Claim 6.

Upon entry of this Amendment, which is respectfully requested, Claims 1-4 and 6-13 will be pending, of which Claims 2-4 are withdrawn from consideration.

Response to Claim Rejections Under § 103

A. Claims 1 and 7-12 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Kass et al. (US Patent No. 6,589,048) in view of Imamura et al. (US Patent Application No. 2002/0164475) and Hamayoshi (JP 2002286397); and

B. Claim 6 has been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Kass in view of Imamura and Hamayoshi, and further in view of Tanaka et al. (JP 04017928).

Applicants respectfully traverse.

Initially, during the Examiner Interview dated November 16, 2011, the Examiner identified U.S. Patent No. 5,649,891 to Kass as applicable prior art. Accordingly, in addition to the above rejections, Applicants address Kass '891 below.

Both of Kass '048 and Kass '891 relate to fuser rollers or heated rollers used in copier/duplicators and printers. Such heated rollers are comprised of a tube and gudgeons (end caps) to seal the respective ends of the tube, wherein the tube is made of a thermally conductive

material such as aluminum, copper or alloys thereof, and the gudgeons are made of stainless steel or a combination of metal and polymer. See, Kass '048, col. 1, lines 13-18 and Kass '891, col. 2, lines 4-5.

Using these materials in heated rollers provides a tube that is readily heat conductive and which enables heat to efficiently reach the surface of the tube to perform the fusing operation. Further, the end gudgeons, being formed of a heat insulating material, prevent heat from escaping from the end of the tube and damaging the support shaft or subjecting other associated elements to excess heat. See, Kass '048, col. 3, lines 4-12. Moreover, in order to precisely controll the fusing temperature, heat loss (from the roller through the gudgeons to the surrounding environment) must be effectively minimized. See, Kass '891, col. 1, lines 28-30. That is, one having an ordinary skill in the art would understand that it is necessary for the surface of the roller tube to have as uniform a temperature as possible across a wide range.

In view of the foregoing, it is apparent that Kass '048 and Kass '891 are in different technical fields from that of the present invention, which relates to a sink roll or a support roll for use in a galvanizing pot.

In addition, one of ordinary skill in the art of Kass '048 would not have any reason to apply Si_3N_4 to Kass '048's roller tube. More particularly, Kass '048's roller tube must have excellent thermal conductivity such as that corresponding to aluminum and copper, which have thermal conductivity values of 250 W/(m·K) and 400 W/(m·K), respectively. See, Thermal Conductivity of Some Common Materials and Gases, The Engineering ToolBox; http://www.engineeringtoolbox.com/thennal-conductivity-d_429.html. However, given that the thermal conductivity of Si_3N_4 is 50 W/(m·K), which is only 1/5 to 1/8 of those of aluminum and

copper, one skilled in the art would have no reason to combine Kass '048 with Imamura and Hamayoshi, as the Examiner asserts.

Regarding present Claim 6, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to form longitudinal grooves by knurling the outer circumferential surface of the shaft portion of Kass '048/Imamura/Hamayoshi, as taught by Tanaka, as an effective means of accurately engaging the joining surfaces of the shafts with the inner surfaces of the hollow body resulting in an enhanced and secured connection.

According to the present invention, the hollow body and the shaft portion are made of Si_3N_4 ceramic which is not able to deform. In this regard, one having an ordinary skill in the art would understand that it is impossible to make a connection between the hollow body and the shaft portion into an enhanced and secured connection by using a method taught in Tanaka. More particularly, Tanaka uses a plastically deformable Al shaft and a metal (steel) pipe to make its connection into secure, effective and strong joint. Further, in Tanaka, there is no aperture communicating with the inside of the roll, since the knurling 2C set on the outer circumferential surface of the flange part 2A (i.e., longitudinal grooves formed on the shaft portion) is bitten with the spiral groove 1A of the steel pipe 1 and buried both in the recessed and protruded parts. See, Abstract.

One of ordinary skill in the art would not have been motivated by Tanaka to form longitudinal grooves communicating with the inside of the roll in order that a molten metal can (i) quickly enter the inside of the roll when the roll is immersed in the galvanizing pot, thereby reducing the temperature difference between the outside and inside of the roll and thus suppressing heat shock; and (ii) be quickly discharged from the roll to prevent a large amount of

a molten metal from solidifying in the roll. See, page 6, line 25 to page 7, line 4 of the present specification.

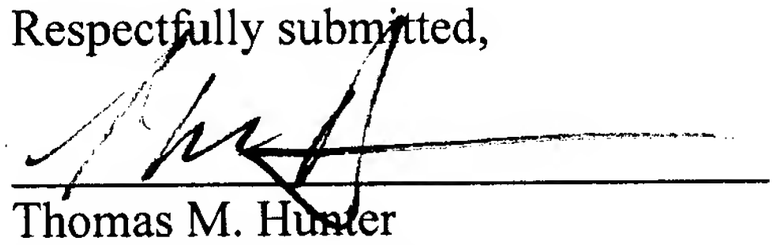
Thus, Kass '048, Kass '891, Irnamura and Hamayoshi fail to render obvious the present claims. Accordingly, withdrawal of the rejections is respectfully requested.

Regarding Claim 11, none of the cited art disclose or suggest a large-diameter portion in the gudgeons (the shaft portion). Moreover, even if the head (shoulder) portion of the gudgeons are considered to be a large-diameter portion, one having an ordinary skill in the art would not selected 0.5-2.0 of a ratio of an effective length Ls to an outer diameter DL of the large-diameter portion of the gudgeons. In fact, the ratio obtained from figures of Kass '891 (and Kass '048) is less than 0.1, wherein a longer Ls would lead to a loss in excellent thermal conductivity and uniform temperature distribution, which are essential for the heated roller of Kass '891 and Kass '048.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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